Modified Taylor Float System for Culturing Oysters in The Gambia

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For the Gambia-Senegal Sustainable Fisheries Project (USAID/BaNafaa)

January 2013

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Citation: Rice, Michael A. (2013). Modified Taylor Float System for Culturing Oysters in The Gambia. Gambia-Senegal Sustainable Fisheries Project (USAID/Ba Nafaa) The Gambia. Coastal Resources Center, University of Rhode Island, pp. 9

Disclaimer: This report was made possible by the generous support of the American people through the United States Agency for International Development (USAID). The contents are the responsibility of the authors and do not necessarily reflect the views of USAID or the United States Government. Cooperative Agreement # 624-A-00-09-00033-00.

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Modified Taylor Float System for Culturing Oysters in The Gambia

The women harvesters of oysters in the Tanbi Estuary system typically work early in the season at most accessible sites closer to their homes to collect oysters from mangrove prop roots (Figure 1); as the harvest season progresses, they venture farther afield and deeper into the mangrove forest in search of larger marketable oysters. One of the by-catch items of the harvesting process are smaller non-marketable seed oyster that are simply culled and discarded. Application of some oyster nursery techniques to hold the oyster seed until they can grow to larger marketable sizes may be a means to reduce this by-catch in the oyster fishery and provide the women a convenient opportunity to be learning a simple aquaculture technique to grow and eventually sell the discarded seed oysters.

Figure 1. *West African mangrove oysters* Crassostrea tulipa *setting intertidally on the prop roots of the Atlantic red mangrove,* Rhizophora racemosa.

Taylor floats (Figure 2) were originally designed by Jake Taylor at the Virginia Institute of Marine Sciences Laboratory at Gloucester Point, Virginia, USA. Floats are constructed of plastic mesh or wire-coated mesh material with floatation provided by capped PVC piping (See: http://www.midshoreriverkeeper.org/Programs%20and%20Initiatives/Oyster%20Float.pdf for some example construction plans). Float baskets should ideally include several size mesh – small, medium, large mesh – so that as the oysters grow, they can be transferred to progressively larger mesh cages that allow better water circulation into the basket while effectively retaining the oysters as they grow.

The materials for construction of a Taylor float variant appropriate for The Gambia, including vinyl-coated wire mesh material of various mesh sizes, PVC pipes and end caps, as well as nylon cable ties (aka "zipties") were found at hardware supply and automotive supply houses in the Metropolitan Banjul area (Table 1). Plastic mesh material such as Vexar® or Netron® is not readily available in the country so a vinyl-coated, galvanized wire mesh (8mm square mesh) was used as a substitute (Figure 3). Total materials cost for construction of the Gambian design was GMD 987.00 or about US$32.90 (Table 1). By North American standards, this is a surprisingly high per-unit cost for constructing a Taylor float style basket, however almost all of the materials used are imported by the dealers and are not commonplace in the country.

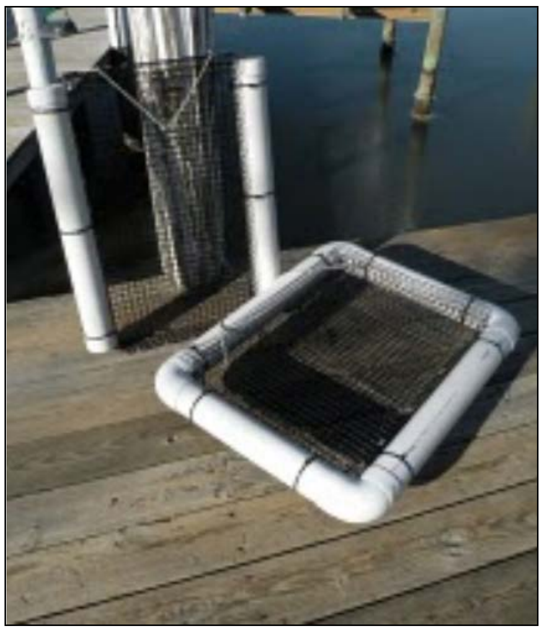

Figure 2. *Examples of Taylor float designs used by the Chesapeake Bay Oyster Company in Virginia, USA (see: http://www.bayoyster.com/equip_go.html). Oyster seed is held near the water surface, and fouling on the apparatus is controlled by periodically flipping the floats in order to expose any adhering fouling organisms to air and sunlight. Photo by Chesapeake Bay Oyster Company.*

The pilot study was begun in January 2011 involving women oyster harvesters from the village of Kubeneh who saved small-sized seed oysters (approximately 10 mm shell height) from their traditional harvesting and placed 150 of these seed oysters (approximate biovolume of 150ml) into each of two floats. The study continued until July 2012 at which time the study was concluded, and the oysters were taste tested by the women of Kubeneh. Oysters reached an average shell height of about 45mm, ranging from about 30mm to 55mm, matching the growth rates of oysters that the women typically see in the wild. However, the women noted that the shape of oysters produced in the bags was much more regular and with shallower cupping than those they are accustomed to harvesting from mangrove prop roots. Thus the production of oysters by floats like these may be a method of choice for producing oysters for the half-shell market, if such a market should develop in The Gambia. During the course of the study, the women reported only two oyster mortalities among the two bags or a 0.67% gross mortality percentage. They also reported that the shucked meat volume of oysters cultured in the floats would be about 3 cups (approx. 700ml) worth a total about GMD60 (about GMD30 = US$1) at their usual market outlets.

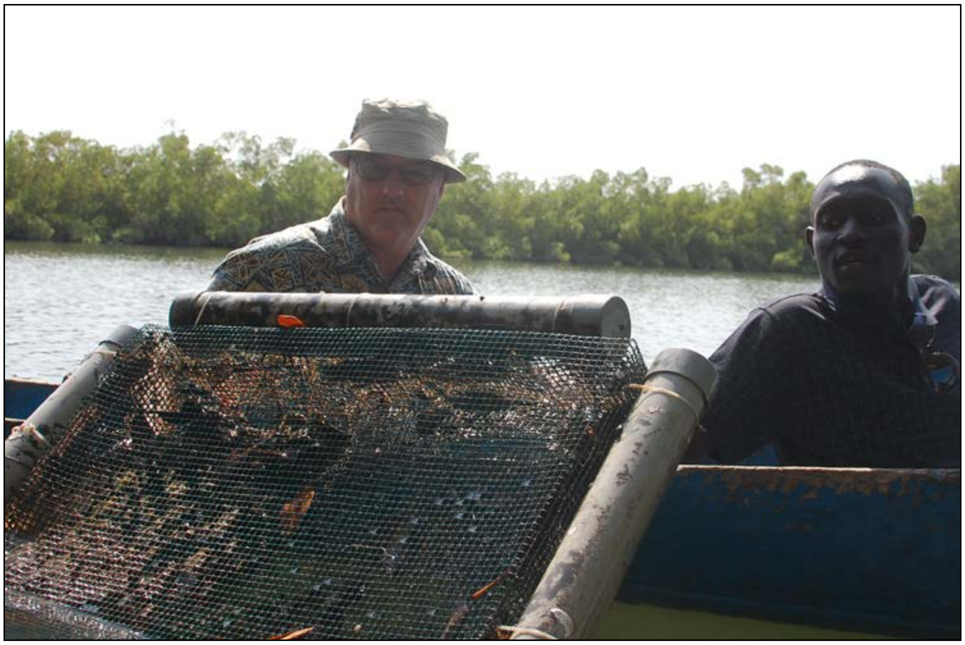

Figure 3. *The modified Taylor float oyster culture basket deployed in the estuary system close to the oyster harvest sites at Kubeneh as demonstrated by Albert Jammeh (r) and Michael Rice (l). In this Gambian variant of the float basket, 8mm mesh vinyl-coated wire is used to replace the plastic mesh (Vexar®) traditionally used in North America. Different mesh sizes were not available, so all experiments were done exclusively using the 8mm mesh coated wire. The image shows oysters (about 30 mm in shell height in the basket occupying about 25% of the volume of the float after about 3 months of deployment into the estuary. Fouling levels on the basket were controlled by the oyster women flipping over the float basket fortnightly so that the upper surfaces can be exposed to the sun and air. Photo by Lina Kelpsaite.*

The current market price of the oysters cultured in the Gambian Taylor float baskets of GMD60.00 does not offset the cost of materials in the first production cycle, although the rate of return per basket may be increased by increasing the stocking density of seed oysters. There is no indication that the growth of the oysters in the baskets was hampered in comparison to nearby oysters in the wild. However, at the current stocking density of 150 seed oysters per float basket, it would take about 17 annual oyster culture seasons to break even on the materials costs of a float basket of this design. Most of the source of the economic imbalance rests largely with the low market prices that the Gambian oyster harvesting women receive for their product in local markets. In contrast, oyster farmers in North America (e.g. Virginia, Rhode Island, Massachusetts, and New Brunswick) who use Taylor float baskets are able to offset their gear costs in one growing season because at a conservative wholesale price of $0.50 per oyster, returns of about $75 per crop would be realized (assuming the stocking densities used in this study), that would well offset similar (or even lower) materials costs for the commonly used North American float baskets.

TABLE 1. CALCULATED MATERIALS UNIT COST OF A GAMBIAN TAYLOR FLOAT BASKET

ITEM	*Units Required*	*Price per Basket*
PVC PIPE 75mm diameter (sold @ GMD50/m)	4m long	GMD200.00
PVC end caps 75mm (sold @ GMD50.00 each	8 each	GMD400.00
WIRE MESH 8mm mesh/1.5 m wide (sold in 30m rolls@ GMD5,500 per roll)	2 meter	GMD367.00
Small Supplies: PVC adhesive @ GMD50 per100ml can & cable ties (sold at (GMD75 per hundred ea)	0.1 can of cement (GMD5) & 20 ea cable ties (GMD15)	GMD20.00
	TOTAL per basket	GMD987.00 (approx. GMD30 = US$1) or US$ 32.90

Despite the unfavorable economics of using Taylor float baskets for culturing Gambian oysters, the experience of constructing, stocking, deploying and tending the float baskets was reported by the oyster women to be a valuable learning experience for the oyster women. They said that they gained an appreciation for the idea of using some sort of aquaculture technique to raise and profit from oyster seed that otherwise would be discarded and lost. They came to the opinion that farming oysters in baskets closer to home would be a valuable savings of time over their usual practice of traveling further and further into the mangrove estuary in search of market-sized oysters as the harvest season progressed. The savings in time allowed the women more time for their other occupational activities (several women stated that they had two or three other sources of income). They also said that farming of oysters in the float baskets was also a safer practice than venturing deep into the mangroves, and they stated that the float baskets allow for the availability of oysters to sell on a year-around basis. An added advantage arises from the fact that damage to mangroves is minimized, because cutting of mangrove prop roots or scraping bark of the roots is minimized as harvest pressure on wild oysters is reduced.

For the various reasons stated by the women, and despite the high material cost of the two prototype Taylor float baskets, the women restocked the baskets with 200 oysters per basket and redeployed them into the estuary at Kubeneh. Without any external prompting, they began to experiment with the stocking densities in order to find the optimum. From their experience in the mangroves, they noticed stunting of oysters in dense assemblages, and had an appreciation for optimization stocking density in the baskets. They have a clear sense that there is an upper limit or maximum profitability per basket based on stocking density.

The oyster women of Kubeneh also realized that the cost of North American style Taylor float baskets is excessive, they began thinking of alternatives. The first alternative they thought of is to use 20-liter polyethylene jugs commonly used for the sale of cooking oil. They proposed putting many holes in a jug and suspending the jug from a tripod of mangrove wood poles in the estuary and stocking with 150-200 seed oysters. The disadvantage of this idea is that the jugs are of relatively high value for hauling water, thus they have a relatively high price in their rural community. The second alternative they envisioned is to modify some open-weave baskets that they typically use to haul oysters around during the post-harvest steaming and shucking process. The baskets are of a semi-open weave design, the grasses and reeds are found locally in the community, and the women make the baskets themselves (Figure 4).

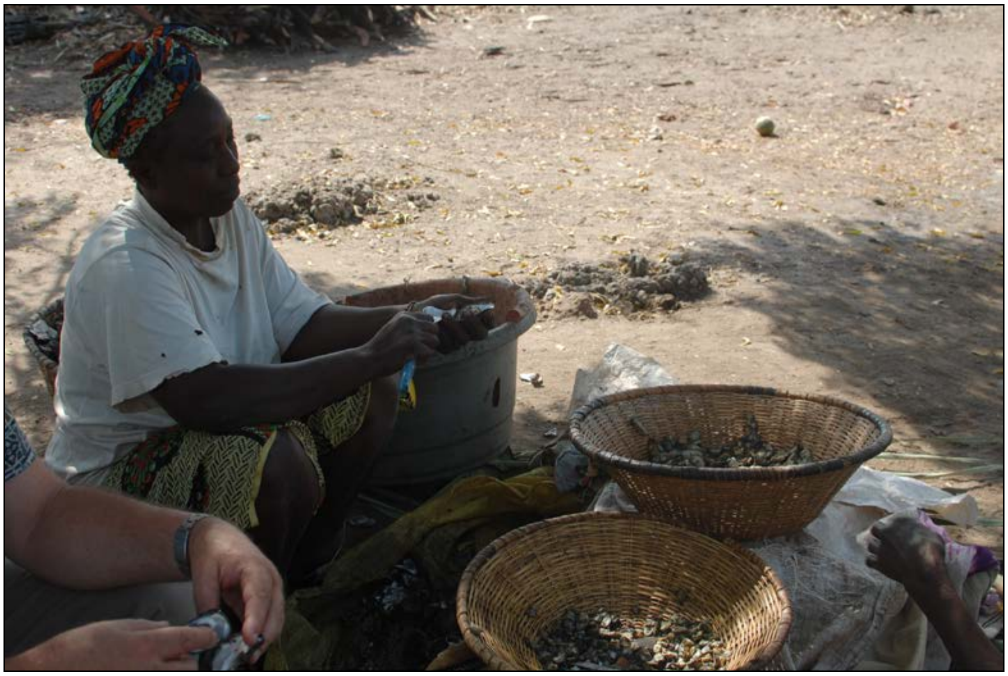

Figure 4. *Utility baskets used by the oyster women of Kubeneh that can be potentially modified by basket makers to serve as culture containers for oysters. Photo by Lina Kelpsaite.*

The advantage of modifying their own basketry for the culture of oysters is that material costs are nil, and the women put their own labor into the baskets. Unresolved issues remaining are the durability of the basketry materials when immersed in sea water for six to seven months. Section of proper materials for construction of the basketry is a key factor in allowing for seven months to a year of durability when immersed in seawater and carrying a heavy load of oysters. Certain locally available caning materials normally used for larger basketry carrying heavy loads might be employed.

Based on normal wear patterns of most load-carrying baskets, the weakest point is typically the bend at the bottom transitioning to the sides. The basket typically fails by the load bursting out the bottom. It is recommended that in the redesign of baskets for oyster culture that the weave be opened slightly more than usual to allow greater seawater flow to the oysters, and that polypropylene box strapping material (often discarded by importers of manufactured goods) be used as a reinforcement material at the base of the baskets to lend greater durability to the load-bearing base (Figure 5). Once the durability of these baskets can be established by the women, they might then proceed to experiment with optimization of oyster stocking densities in these new baskets. One added consideration for stocking density is the weight of the oysters as they reach market size and the basket has been immersed for several months.

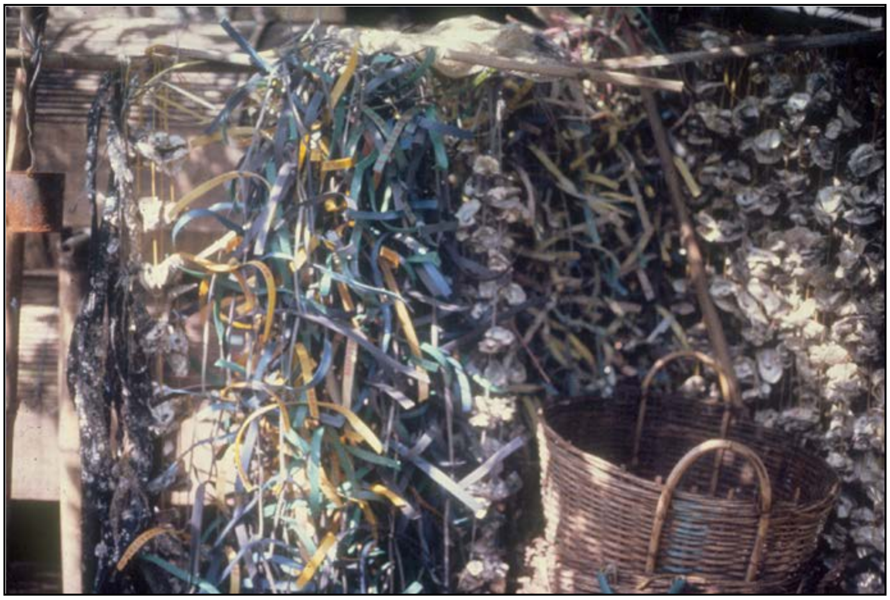

Figure 5. *Various materials can be used for oyster spat collection include rubber strips from waste automobile tires (left), waste polypropylene box strapping material (center), and oyster shells strung on to polypropylene ropes (right). In addition to use as spat collectors, polypropylene box strapping material that can be used for reinforcement of basketry used for grow-out culture of oysters to market size. Photo by M.A. Rice in Dagupan City, Philippines 1983.*

Conclusions and Recommendations:

The data show that at the current domestic market prices for oysters, Taylor Float baskets constructed from locally available materials from hardware and plumbing supply stores in metropolitan Banjul are not likely to be a profitable means for producing oysters unless high-end half-shell oyster markets are developed. However the experience with working with the floats has exposed the oyster women of Kubeneh to the methods of oyster farming and they have self-reported that for a variety of reasons, aquaculture of oysters is a more desirable means to produce oysters that their traditional harvest from mangrove prop roots. The oyster women have taken the initiative to restock the Taylor Float baskets with a higher stocking density of seed oysters in order to find the optimum harvest yield. Additionally, they have made the initiative to explore cheaper alternative solutions to culture oysters to market size through modification of local basketry.

It is recommended that the TRY Oyster Women's Association, the Gambian Department of Fisheries under the auspices of their responsibilities under the 2012 Oyster Co-Management Agreement between TRY and the Gambian Government as well as the USAID/Ba-Nafaa Project continue to lend technical and modest financial assistance to the oyster women of Kubeneh in their activities to develop and refine their skills in culturing oysters using the two existing Taylor Float baskets and to support their efforts to develop alternative culture gear using locally available basketry materials.